THE DISAPPEARANCE OF THE ENHARMONIC GENOS IN ANCIENT GREECE[1]*

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ABSTRACT

In this paper, I study to which extent singing and the organic difficulties our anatomy has to tune certain intervals could have been one of the possible reasons why the enharmonic *genos*, considered among the ancient Greeks the most beautiful one, could have disappeared in such an early stage as the Classical period. Most probably it had already disappeared when Aristoxenus wrote his *Elementa harmonica* in the fourth centuryBCE. In any case, it is not found in any example at all in the Hellenistic phase, having been replaced by the other two *gene*: the chromatic and the diatonic. I shall research those matters in relation with the vocal technique used by singers and why they could underlie as one of the reasons that contributed to the extinction of the practice of such a *genos*. I shall analyse the difficulty of the internal organisation of the enharmonic intervals inside the tetrachord, especially when it needed to be executed with the voice as an instrument.

Keywords: Enharmonic *genos*, vocal technique, music, Classical Greece.

Fortunately, studies that combine Classics and Archaeomusicology have increased considerably during the past decades. However, the approach to these

*English version by the author.

subjects is quite scarcely done from the singers' point of view and their vocal technique. One of the reasons for this is that all our evidence comes from the interpretation of ancient texts, which sometimes are not easy to follow, and from the analysis of the extant iconography, whose symbology is difficult to interpret in many cases. Before I start this paper, we need to assume a pre-hypothesis for the research, that is, that we have the same anatomical conformation for producing voice as the ancient Greeks, although singing techniques have changed (Calero 2016). Analysing singing of past ages on a comparative vocal basis was first attempted by Ethnomusicology. Even though his theories are nowadays questioned, Alan Lomax (1959, 1968) was successfully able to isolate patterns that were valid for different times and cultures. This credited him as father of the Ethnomusical universals. These are not easy to define, but are investigated from the fact that humans, as species, make music according to certain particular structures, despite the vast number of particularities that may define each specific culture around the world. These universals are difficult to isolate, but some of them are commonly accepted by researchers, like the concept of musicality, the existence of mechanisms to preserve musical traditions and the ubiquity of repertoires developed for children. There are sounds that are considered apt music for everyone, whereas some others are rejected by most cultures. Tetratonic and anhemitonic pentatonic scales (internally organised with major seconds and minor thirds), octave singing between men and women (or children), strophic structures of songs and the use of idiophone instruments to accompany singing seem to be some other universals. Singing is, undoubtedly, a basic universal in our species (Nettl 2005).

It is my aim to undertake the study of one of the possible reasons why the enharmonic *genos*, considered by the ancient Greek theorists the most beautiful of the three *gene*, could have disappeared during the Classical period, despite the fact that, according to texts (all of them written after its alleged disappearance), it was the most suitable for the dramatic genre that flourished during the age that made actors the real stars of the stage.[1] I shall therefore try to analyse to which extent singing and the difficulties singers must have had to tune the microtonal intervals that conformed the enharmonic *genos* could have been one of the reasons that caused its extinction.[2]

[1] In ancient Greece, actors must always be considered singers too, first of all for the musical character of ancient Greek language itself, and, secondly, because recited voice in Antiquity can never be understood without its sung counterpart (Barker 1989; West 1994, 1997; García López, Pérez Cartagena, Redondo Reyes 2012; Hall 2007; Calero 2016).

[2] Microtonality is a modern conception that implies a theoretically uniform twelve-semitones system according to our equal temperament tuning. Microtones are smaller intervallic sections than the semitone. It is an anachronism to examine the ancient Greek microtonality problems from the point of view of a system that was born in the middle of the eighteenth century.

Baud-Bovy (1986) affirms that all those musicologists that have studied music with micro-intervals insist on the fact that the division of the tone in more intervals doesn't imply the effective use of thosesmaller than the semitone. These divisions have never been played one after the other, but only in relation with the rest of them. Let us remember that, for instance, Indian music forbids the interval of one microtone (*shruti*). Besides, quartertones are usually used as embellishments to raise or lower notes of a scale, as it normally happens in folk music, e.g. in Arabic music or flamenco.[1] We should not think of ancient Greek music as an exception to this rule.

Finding the smallest interval that can be heard by the human ear has been a practice we know of from ancient dates. Thus, Plato (*Republic* 531a.4-b.1)[2] rises against those theorists that develop their work just seeking to find it in their need to establish a unit of measurement, sometimes at the limits of the human capacity of perception. I agree with Barker (2007) when he explains that the fact that our ears cannot pick out a smaller interval than a quartertone does not at first sight guarantee that an interval such as one spanning one-and-a-third tones is unidentifiable and musically unusable, but, if no smaller interval than the quartertone can be recognised, the truth is that we cannot hear the difference between those intervals and any interval that lies between them. At the very most, we may be able to hear that one of them is larger or smaller than the other, but not to which extent they are different. This is how we must understand Plato, when he considered that wasting-time labour of listening to chords and measuring sounds a tendency that lacked interest, for there was no agreement among the researchers due to the empirical part of the process.[3]

A bit later on, Aristoxenus will treat the term *harmonikoi* in a more specialised way than Plato or Aristotle, who scarcely used it referred to those that researched the *harmoniai*. Aristoxenus employs it to allude his own generation and close predecessors, whohad started to use an empirical approach to the matter, apart from the mathematical science the Pythagoreans developed. Singing is, to a great extent, an auditory art and a science of hearing. Thus, Aristotle affirmed (*Pr*. 898b.28 [= XI 1])[4] that hearing and voice had the same origin.

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[1]Sachs 1943, Gil Ruiz 2014.

[2] All the text references used for this article belong to the *Thesaurus Linguae Graecae* and the editions used in it. Any exception to this rule will be specified *in situ*. Ancient authors and their works are cited according to the *Liddell-Scott-Jones Lexikon* for ancient Greek. All translations are my own.

[3]This same idea appears in Eusebius (*Preparatio evangelica* 14.13.6.3-5): "Some of them affirm that they can perceive a sound in the middle of the other two, thus finding out the smallest interval, whereas others reply that that sound is similar to the other ones" (οἱ μέν φασιν ἔτι κατακούειν ἐν μέσῳ τινὰ ἠχὴν καὶ σμικρότατον εἶναι τοῦτο διάστημα, ᾧ μετρητέον, οἱ δὲ ἀμφισβητοῦντες ὡς ὅμοιον ἤδη φθεγγομένων).

[4] The Aristotelian *Problems* are cited by page and line, according to Bekker's edition in the*Thesaurus Linguae Graecae*(Berlin, De Gruyter, 1960 [= Berlin, Reimer, 1831]), followed between brackets by their

This new trend tried to describe real musical structures from the experience perceived by our ears. These *harmonikoi* investigated music in the enharmonic *genos*, for they claimed it was the most sublime of them all. Let us bear in mind that the distinctions between the three *gene* that will be discussed in this article (enharmonic, chromatic and diatonic) were neither formalised nor given names until the fourth century BCE.

Centuries of literature can be resumed in Saint Isidore of Seville's words. He affirmed (*Or.* 3.20.10-14) that "the perfect voice had to be high, sweet and resonant: high to be similar to the high notes, strong to fill the ears, and sweet to reach the soul". Having examined Greek Literature, one comes to realise that that is exactly what*ligeia fone* (λιγεία φωνή) means passim in Greek texts. The two most employed Greek adjectives are *ligys* (λιγύς) and *ligyros* (λιγυρός) when ancient authors want to describe a full, resonant, powerful voice.

Actors/singers were acclaimed or booed for their interpretative quality as well as for their technical virtuosity. But acquiring the smooth and well-tuned singing that audiences demanded was not always an easy task, being as they were obliged to perform with that *ligeia-fone* technique that implied a big volume and a brilliant resonance that might help them carry their voices through big spaces, but that could cause, in many cases, a good lack of vocal flexibility (Calero 2016). Let us remember Theophrastus' commentary in *De musica* (apud Porph. *In harm*. 63.1.6), where the author claims that "sometimes performers, in order to sing a high note, need to stretch their thorax sides and trachea with force, whereas, when they try to reach low notes, they shorten their throats".[1]

This text may be reflecting why actors-singers are usually represented in vases with their necks and head bent backwards and their chin pointing upwards. It has been usually said that singers with those postures in the iconographic extant examples show a performing trance, giving the idea of being in ecstasy due to their physical attitude, for they hold their head risen up as if they tried to get in closer contact with the gods, inspired by them in an act of, literally speaking, *enthusiasm* (ἐνθουσιασμός).[2] As Sachs (1937) points out, this ecstatic condition has its origins

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equivalent of section, in Roman numbers, and of problem, in Arabic numbers, as they appearin Louis' edition (*Les Belles Lettres*, Paris, 1991).

[1] Δῆλον δ' ἐκ τῆς βίας τῆς γινομένης περὶ τοὺς μελῳδοῦντας· ὡς γάρ τινος δέονται δυνάμεως εἰς τὸ τὴν ὀξεῖαν ἐκφωνῆσαι, οὕτω καὶ εἰς τὸ τὴν βαρεῖαν φθέγξασθαι. ἔνθα μὲν γὰρ συνάγουσι τὰ πλευρὰ καὶ τὴν ἀρτηρίαν ἐκτείνουσι [διὸ βραχύτερον] βίᾳ ἀποστενοῦντες· ἔνθα δὲ διευρύνουσι τὴν ἀρτηρίαν, διὸ βραχύτερον τὸν τράχηλον ποιοῦσι τὸ μῆκος τῆς εὐρύτητος συναγούσης. The term "larynx" will not be employed in ancient descriptions of the vocal tract until Galen (2nd century CE), who is the first authors that distinguishes "trachea" and "larynx". Until then, it was commonly named "trachea" (*arteria*, ἀρτηρία) and only the context will permit us understand which one is meant in each case (Calero 2016).

[2] Cf. Aristides Quintilianus (2.4.65-70.3) a little further on. The term "enthousiasmos" literally means "the result of being inspired or possessed by a god" in Greek.

in the most primitive core of our species and dominates not only the throat but also our limbs, for the intoxication suffered by the individual is produced by melodies and by the rhythmical accompaniment of dance, as can be observed in Bacchic or satyric scenes, generating a spiritual connection between both expressive contexts.

However, there is another explanation for these representations that I would like to stress. It has to do with the anatomical suspensory mechanism of the larynx. Respiration is a fundamental cyclic process with obvious responsibility in the spoken and the sung voice. It is the force that coordinates the different parts of the anatomic mechanism. For singers, the breathing system is a multifaceted reality of which they have no real conscience, as it is formed by a group of muscles that work in synergy in the lower intercostal spaces, the diaphragmatic zone, the back muscles and the abdominal region, and that produces the breathing column of air that makes the vocal folds vibrate. Therefore, it is a mechanism of great complexity, but basic for a successful singing. The collaboration between the respiratory system and the vocal tract gets done in our body through what is called the suspensory mechanism of the voice, that coordinates both parts and balances their work (Husler 1983; Harrison 2006, 2014; Dimon 2011; Calero 2016).

Mechanically speaking, this muscular system works as follows: the larynx is powerfully suspended into the throat by a structure of paired muscles. Some of them, the elevators, pull upwards (forward and to some extent back as well), whereas the depressors draw at the same time downwards (as well as forward and back too).[1] This creates a mechanism that pulls on the larynx on four directions at the same time, affecting as well to the degree of tension of the vocal folds and the laryngeal cavity above in an unlimited manner.

So, what happens when this system in not working to assist the voice while singing? According to Husler (1983) and Harrison (2006), when this structure is partially or entirely lacking, as I suspect it was in Antiquity, the result would be a weak form of falsetto, without any possibility of strengthening it so as to pass into the full voice, or a tight voice with inaccessible high notes. Contemporary research on vocal technique shows that, even though it may seem an easy task, it is usual to find this system in a very weak condition or even in an absolute collapse, albeit powerful in spontaneous situations such as laughter, crying, sneezing, and so on.

This poorly balanced voice is very common in popular singing. It can also be easily observed nowadays in amateur singers, mainly in high male voices, that

[1] The elevators are the shield cartilage-tongue bone muscle, the thyreo-hyoideus; the muscle palato-laryngeus-tensor, veli palati; and the muscle stylo-pharyngeus. The depressors, on the other hand are the paired chest bone-shield cartilage muscle, sterno-thyreoideus; the crico-pharyngeus muscle; and, in addition, the wind-pipe and the oesophagus pull, to a certain extent, on the larynx as well (Husler 1983).

generate a constant constraint on the larynx, due to their lack of training, in their need to reach the top range of the vocal pitch. However, this is not something that happens only in our time. It also happened (and was observed, although not with the same technical approach that we have nowadays) in ancient Greece. Evidence of it is what seems to be commented in the next two examples of Ps. Aristoteles' *Problemata*, that looks quite similar to what Theophrastus means in the text we have quoted before:

> *917b 30-34 [= XIX 3]: Why voice breaks (ἀπορρήγνυνται) to those mainly when they sing the note parhypate no less than when they sing the nete and the high notes, that imply a greater interval? Is it because singing that note is difficult and it is itself a principle? What is difficult is due to the tension and the compression of the voice (διὰ τὴν ἐπίτασιν καὶ πίεσιν τῆς φωνῆς): there is an effort in it and what is submitted to an effort gets more damaged (διαφθείρεται).*
> *917b 35-918a 2 [= XIX 4]: Why singing that note is difficult, but the hypate is easy, even though there is only one diesis between each one of them? Is it because the hypate implies relaxation (μετ' ἀνέσεως) and, at the same time, after tension, it becomes light to go up (τὸ ἄνω βάλλειν)?*[1] *For the same reason, it seems that what we have said serves for this or the paranete too.*

These two fragments reflect that there was a technical difficulty for those that had not been graced by nature with an easy voice, because they indicate that singers had problems to reach both the low range of the voice (*hypate* and *parhypate*) and its high range (*nete* and *paranete*) in what nowadays is considered to correspond with the low and high extremes of the male voice, i.e. around b_2 or b^b_2 and f_3 *or* g_3 (Barker 1989, West 1994, Hagel 2009, Calero 2016). If the suspensory mechanism of the larynx is undertrained, it, as well as the tongue, pulls the throat muscles back and downwards, also causing a stressed elevation of the chin. The resultant sound is constrained and narrow, having an intense nasal quality produced in the front resonators of the face. The body tends to adopt an inadequate posture, with a contracted back that does not allow the column to stretch completely. The larynx gets fixed against the base of the tongue to compensate the effort. The result is a body position quite similar to that that can be observed so often in the representations of singers in Greek vases, and, consequently, it implies difficulties in singing for the lack of flexibility of the instrument (Husler 1983; Harrison 2006, 2014; Dimon 2012;Calero 2016).

In this technical context, it is important to see now to which extent singing technique could have influenced the evolution of the enharmonic *genos*. One of the principal problems ancient Greek singers had to deal with during the Classical period was the theoretical and aesthetic imposition of a physical and acoustic

[1] Does this text imply the falsetto that comes naturally in male voices after singing around a constraint f_3? However interesting this idea can be, there is no way to affirm it categorically.

system that divided the mobile parts of the tetrachord in extremely short sections. These could be easily retuned in instruments varying the tension of the chords. Wind instruments permitted the players to modify the intervals closing the holes partially with the fingers or modifying the air pressure with the lips. However, and considered what I have explained before, for those who used the voice as their working instrument, this musical system bore no little technical difficulties.

Greece, heiress of the diatonic practice that had been imported from the Near East[1] in the transmission of music from court to court, had developed from a certain moment a particular and personal language with the chromatic and enharmonic *gene*, as proper Hellenic musical idiolects far from the *lingua franca*into which the archaic diatony had turned.[2]Nevertheless, despite the importance acquired by the three of them in ancient Greek music, each one of them had a different historical evolution in Greek tradition. Only the diatonic and the chromatic reached the Hellenistic period, whereas, in Roman times, evidence only shows examples in the diatonic *genos*, the so-called "most natural" by the ancient theoreticians of music (West 1994, Barker 2007, García López, Pérez Cartagena & Redondo Reyes 2012). For Aristoxenus (*Harm*. 24.20-25.4), "it appears firstly in the nature of man" (πρῶτον γὰρ αὐτοῦ ἡ τοῦ ἀνθρώπου φύσις προστυγχάνει), idea on which Aristides Quintilianus will insist several centuries after him, adding (1.9.16-24) that there is no need to receive musical education in order to feel capable of singing it (πᾶσι γὰρ καὶ τοῖς ἀπαιδεύτοις παντάπασι μελῳδητόν ἐστι). We can check it out ourselves if we sing a simple ascending or descending scale. We shall then obtain a scale ordered through a diatonic system of tones and semitones. According to Mithen (2006: 91), this is so, for it seems to be directly related to a psychological meaning, inherent to the human species, that has to do with the way in which diatonic intervals are organised in our brain.

These three*gene* were an important element in ancient Greek music. They were treated and developed by harmony[3] theoreticians not only for the interest the mathematical part of it arose in them, but also for the ethic quality the three genres implied in the education of citizens. This is how one must understand the subject in Aristides Quintilianus (2.4.65-70.3):

> *Some people are moved by pleasure in happiness (ἐν εὐθυμίαις ὑφ' ἡδονῆς), some others by sorrow in grief (ἐν ἀχθηδόσιν ὑπὸ λύπης) and some others, possessed by a divine impulse and inspiration, by enthusiasm (ὑπὸ θείας ὁρμῆς καὶ ἐπιπνοίας*

[1] Cf. West 1997; Crocker 1997, 1978; Franklin 2002a, 2002b, 2006, 2008, 2015; Calero 2017.

[2] Diatony is attested at least from the 1800 BCE, as the Tuning Text 7/80 of the British Museum confirms (cf. Crocker 1978).

[3] The term "harmony" belongs to the same lexical family as *harmotto* (ἁρμόττω), "assemble, put together". It derives from the same Indo-European root **h₂er-* to which "rhythm" (*rhythmos*, ῥυθμός) and "number" (*arithmos*, ἀριθμός) also belong, in the sense of "assemble, adjust, connect, fit together" (Luque Moreno 2014: 127-129)

κατεχομένους ὑπὸ ἐνθουσιασμοῦ), or even by all these causes entangled among them in some events and circumstances, for children, because of their age, and adults, because of the weakness of their nature, are dragged by such passions.

This vision of music is directly related to the ideas of Plato, who must have been inspired by Damon's theories on music, for he shows a great interest in stressing in his writings the way musical *gene* modify our behaviour. Thus, for instance, it can be read in the *Republic* (436a.8-b.3):

[...] However, it is difficult to realise if in all cases we act just through one genos or if, being as they are three gene, in one case we act through one only genos, on other through another one. For instance, through one of these gene that exist within us we learn, through another we are passionate and, in turn, by the third one we relish the pleasures related to feeding, procreating and those similar to these.

What was then the internal structure of these three harmonic systems ancient writers talk about and how could it affect to singers? The tetrachord, system on which the whole theory of ancient Greek music was founded,[1] is the basis on which the three *gene* are built on. Its two extreme notes are fixed in a distance of a perfect fourth (two and a half tones, five semitones or 500 cents of distance between them),[2] whereas the two internal notes are mobile and susceptible to be tuned in diverse ways. The fourth was the smallest consonant interval recognised in Greek music theory (e.g. Ptol. *Harm.* 1.5.3-6and Plu. 1139.C.10-D.4). Depending how its internal notes are organised, the three *gene* will be distinguished. This means that, if one takes the two extreme notes, immobile as they must remain, the other two, that will be kept framed between them, can be tuned with different intervallic distances in relation with the extremes. Therefore, ifthe tetrachord is structured as tone, tone and semitone (200 + 200 + 100 cents), we are dealing with the diatonic *genos* (διάτονον); if it is semitone, semitone and tone and a half, it would be the chromatic one (χρωματικόν, 100 + 100 + 300 cents); and if it were aquartertone, quartertone and two tones, we should recognize the enharmonic one (ἐναρμόνιον, 50 + 50 + 400 cents). Thus, if we had to explain the *gene* on a diagram, we would do it the following way:[3]

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[1] Cf. Michaelides 1978, West 1994, García López, Pérez Cartagena & Redondo Reyes 2012, Calero 2016.

[2] In order to find a solution to the internal problem to the exact measure of intervals within the tetrachord, it is usual to speak of cents in order to calculate the diastematic distances between them. This system was invented by A. J. Ellis (1814-1890), philologist, mathematician and musicologist, who divided the octave into 1200 cents, so that each semitone of the equal-tempered octave equals 100 cents. Using it, we can be extremely accurate in measuring intervals, no matter how irregular they may be. The real perfect fourth, according to the Pythagorean interval, is 498 cents, and not the usual 500 cents we use in our post-eighteenth-century system, the same way the fifth is 702, instead of the actual 700 cents we tune it in nowadays (Sachs 1943: 28, West 1994: 11).

[3] For the rest of my argumentation, and following most of the researchers of music in Antiquity, I shall keep the convention of assigning the modern height of an *e* for the *hypate*, an *f* for the *parypate*, a *g* for

diatonic:	*e*	*f*	*g*	*a*
chromatic:	*e*	*f*	*f*♯	*a*
enharmonic:	*e*	*e*⁺	*f*	*a*

Vocal technique, as it can be seen in the extant iconography and in texts such as Theophrastus' (*De musica*, apud Porphirius *In harm*. 63.1.6), did not characterize by being necessarily flexible in Antiquity, but by being powerful and resonant (Calero 2016). This, as we have seen, affected the suspensory mechanism of the larynx, so that a lack of flexibility and mobility must be presumed in vocal performances, affecting consequently the singers' capacity to tune excessively small intervals. Therefore, if singing the enharmonic *genos* supposed serious problems to performers due to the characteristics of its internal particularities, the chromatic, that must have been replacing the former because of the melodic similarities Aristoxenus points out, must not have been easy for singers either, specially in some of the *colorations* (χρόαι), as in the chromatic "smooth"and the "hemiolion" (vid. infra). This system of *chroai*, understood as different shades or nuances of each *genos*, appear described by Aristoxenus, Cleonides and Ptolemaeus (Michaelides 1978, West 1994, Barker 2004). The coloration taxonomysupported by Aristoxenus (30.19-35.7) implies a system that attributes different *colours* to the *gene* and distinguishes several types that apply only to the instruments, but that become entirely theoretical and applicable with difficulty to the voice, for such minimal differences cannot be distinguished by hearing. It becomes, then, a system built mainly for musical instruments and designed according to mathematical measurements. For the enharmonic, he recognises only one colour (*chroa*) between the *hypate*and the *mese*. It was formed by 1/4 tone + 1/4 tone + 2 tones (50 + 50 + 400 cents), as we have already said. However, for the chromatic he classifies three types: the "soft or *malakon*"(μαλακόν, 1/3 tone + 1/3 tone + 22/12 tone; 67 + 67 + 366 cents), the "hemiolion", (ἡμιόλιον, 3/8 tone + 3/8 tone + 21/12 tone; 75 + 75 + 350 cents) and the "tonal"(τονιαῖον, 1/2 tone + 1/2 tone + 1 tone and a ½; 100 + 100 + 300 cents). This last one has remained being used until our days in music of the oriental Mediterranean. Finally, he distinguishes two colorations for the diatonic: the "soft or *malakon*"(μαλακόν, 1/2 tone + 3/4 tone + 5/4 tone; 100 + 150 + 250 cents) and the "tense or *syntonon*", σύντονον (1/2 tone + 1 tone + 1 tone; 100 + 200 + 200 cents).[1]

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the *lichanos* and an *a* for the *mese*, being aware that it is absolutely theoretical and that we use it only in order to make ourselves clearer in an easier way, according to the modern theory of music language. On the names of the notes in the ancient Greek system, uid. García López, Pérez Cartagena, Redondo Reyes (2012: 274-276), Hagel (2009: 1-51), Michaelides (1978, s.vv.) and West (1994: 219-223).I use the sign + to indicate the elevation of a quartertone on the note.

[1]Aristoxenus (27.18-19) explains that a tone can be divided in a half (= semitone, ἡμιτόνιον), in a third (= minimal chromatic diesis, δίεσις χρωματικὴ ἐλαχίστη) and in a quartertone (= minimal enharmonic

This classification reached Aristides Quintilianus's days (1.9.10-16), even though it must be absolutely theoretical and not practical in his time (as it most probably was in Arixtoxenus's time too; cf. Baud-Bovy 1986):

> *Each of these gene is sung the following way: the enharmonic towards the top range by diesis,[1]diesis and non-compound ditonon[2] (κατὰ δίεσιν καὶ δίεσιν καὶ δίτονον ἀσύνθετον) and the other way round towards the low range; the chromatic towards the top by semitone, semitone and trisemitone (κατὰ ἡμιτόνιον καὶ ἡμιτόνιον καὶ τριημιτόνιον), and the other way round towards the low range; and the diatonic by semitone, tone and tone towards the top (καθ' ἡμιτόνιον καὶ τόνον καὶ τόνον), and the other way round towards the low range.*

Aristides Quintilianus (1.9.1-8), reconsidering the aristoxenic theory, defines *genos* as a certain division of the tetrachord (γένος δέ ἐστι ποιὰ τετραχόρδου διαίρεσις) in which he distinguishes the three types according to the narrowness or amplitude of their intervals (ἁρμονία χρῶμα διάτονον, ἐκ τῆς τῶν διαστημάτων ἐγγύτητος ἢ μακρότητος λαμβάνοντα τὰς διαφοράς). He stresses that in the enharmonic predominate the smallest intervals, which he calls «diesis» in his text, whereas in the diatonic prevail the tones, becoming the *genos* in which "the voice stretches exceedingly to the uttermost"(σφοδρότερον ἡ φωνὴ κατ' αὐτὸ διατείνεται), and "in the chromatic, semitones get emphasised"(χρῶμα δὲ τὸ δι' ἡμιτονίων συντεινόμενον).

On this basis, as Hagel (2009) points out, within a living oral tradition like the Greek one, microtonal shadings of these types would more easily change unnoticed than be preserved against a general stream, affecting mainly singers and, to a certain extent, lyre players. Aristoxenus affirms (19.12-14) that "what the voice is incapable of producing and the ear of judging must be excluded from the use" (ὃ γὰρ ἀδυνατοῦσιν αὗται ἡ μὲν ποιεῖν ἡ δὲ κρίνειν, τοῦτ' ἔξω θετέον τῆς τε χρησίμου καὶ δυνατῆς ἐν φωνῇ γενέσθαι διατάσεως). This affirmation must be taken as a first hand clue about the main problem singers had to deal with in intoning music during the period in which the enharmonic *genos* was used, at least for instruments, i.e. before Aristoxenus's time, and about one of the possible causes to a large extent for its extinction, mainly if the suspensory mechanism of the voice

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diesis, δίεσις ἐναρμόνιος ἐλαχίστη). Any interval smaller than these belongs to the speaking voice, whose diastematic inflections cannot be distinguished, becoming consequently impossible to be sung (τὰ δὲ τούτων ἐλάττονα διαστήματα πάντα ἔστω ἀμελῴδητα). See Franklin (2002a: 673-675).

[1] Diesis is the smallest interval the human ear can distinguish. It is approximately a quartertone and belongs to the group of the non-compound intervals, indivisible, unlike the compound ones (like the fourth), and those that participate of both categories, like the semitone and the tone. Ancient Greek Music Theory recognises two kinds: the minimal chromatic diesis, equal to a third of tone, and the minimal enharmonic diesis, equal to a quartertone (Arist.Quint. 1.7.22-24).

[2] A *ditonon* in ancient Greek theory is equivalent to a major third (81:64, 407.82 cents) as the result of the succession of four perfect fifths (3:2) (Michaelides 1978, Barker 2007, Hagel 2009).

was not part of the vocal technique the ancient Greeks employed for their singing.

Besides, it was in close connection with the complexity of the vocal tuning of different combinations of diesis and of groups of diesis. Let us remember that, in the basis of the Aristoxenian theory lies the fact that hearing is an indispensable condition for turning musical knowledge in an experience (ἐμπειρία), so that the roots of the harmonic knowledge just appear after the perception of the senses (αἴσθησις). However, for my argument sake, we must not forget that Aristoxenus (42.8-13) reminds us that it is through our ear that we can measure the size of the intervals and that through the reason we can understand their melodic functions (τῇ μὲν γὰρ ἀκοῇ κρίνομεν τὰ τῶν διαστημάτων μεγέθη, τῇ δὲ διανοίᾳ θεωροῦμεν τὰς τούτων δυνάμεις). Thus, I follow Bélis (1986: 205-209) when she suggests that no one can neither understand nor use in the practice of music anything that is not heard.

The Aristoxenian diesis has the same role as the Pythagorean comma, a musical interval that results from the difference between twelve perfect fifths and seven octaves that makes, among other things, that the interval of fifth is not exact, but a comma bigger than the fifth by one diesis. Because of it, if the Pythagorean tuning is kept, the cycle of fifths doesn't produce a closed circular system as it happens in the modern tempered one. Under these circumstances of physical acoustics, our senses, voice and ear, are incapable of emitting or distinguishing any interval smaller than a descending diesis, as Aristoxenus himself affirms (19.15-20.1). In an ascending sense, this same author sustains that "the ear feels a bit more capable of distinguishing the interval, but not very much" (ἐπὶδὲτὸμέγατάχ' ἂνδόξειενύπερτείνεινήἀκοὴτὴνφωνήν, οὐμέντοιγεπολλῷτινι). It seems clear that, in Aristoxenus' affirmation, underlies the idea of the tuning of quartertones as a problem for singers. The rational expression of the enharmonic minor diesis is 128:125 and its comparative magnitude is 41 cents, which can't be practically recognised for human hearing.[1] This would agree with the idea that at the end of the Classical period there must have been an evolution from the quartertone to semitonesthat function as leading notes, in what seems to be the extinction of the enharmonic *genos* (Hagel 2009).

That the enharmonic *genos* must have been nearly extinguished in Aristoxenus' time can be supportedby the contents of the Hibeh papyrus on music, dated around the 390 BCE.[2] However, its theoretical knowledge is proved in all the treatises that have survived, as well as the reasons why the three different

[1] Smith, Delgutte & Oxenham 2002;Rodman 2003.

[2] Papyrus number 13 of the edition by Grenfell & Hunt (*The Hibeh Papyri*, London 1906). Although the papyrus seems to be of the 3rd century BCE, according to Barker (1989: 183-184), its contents must be at least a hundred years earlier. The text looks like an extract of an isocratic-style discourse against practical music. We can, therefore, deduce that it must be previous to Aristoxenus, as it assures that the enharmonic *genos* was used in tragedy.

*gene*happen, as Aristoxenus observes when he explains (29.3-5) that the "tensions" and "distensions"(ἐπιτάσεις τε καὶ ἀνέσεις) of the mobile notes are the natural cause of the variations of the *gene*. He also proposes the variation range every note possesses. For him (19.5), every sound, either from an instrument or from the human voice, must have a minimal and maximal extension that will be delimited by the two faculties that intervene in the process: the one that produces the sound (voice, φωνή) and the one that judges it (ear, ἀκοή).

In this same sense, Ptolemaeus (1.1.1-21), following Aristoxenus' ideas (42.8-13), emphasizes that ear and reason (ἀκοὴ καὶ λόγος) are the only valid criteria for harmony comprehension. He differentiates the capacities of each one of them. The former is related to substance and affection (παρὰ τὴν ὕλην καὶ τὸ πάθος), whereas the latter is to form and cause (παρὰ τὸ εἶδος καὶ τὸ αἴτιον). Ptolemaeus claims that this happens like this, because reason is simple and without mixture (ἁπλοῦν τε εἶναι καὶ ἀμιγῆ), bestowing an independent character to it, with order and similar to regular things, whereas, in his opinion, perception has to do with the changing substance, so that it doesn't stay invariable in relation to the same stimulus, always needing the reason to assist it. In short, the limits that define the diastematic distances between two sounds get lost in such a musical system, as Bailey, McGilvray & Hair (2008: 1-13) defend.

The result of all this is clear: the use of the enharmonic diesis must have been terribly difficult to perform vocally, given its given difficulty to be heard by human ear.[1] And that must be the explanation we need to understand implied in Aristoxenus' words when he claims (30.5-8) that the composers tended to employ most of the time the chromatic *genos*, to scarcely fall in the enharmonic. This *genos*must have been most probably dragged in its tuning towards the chromatic, due to its character.[2] Aristoxenus also refers (36.5-12) to the impossibility of singing more than three diesis one after the other, due to the auditory effort it carries. He claims that the performer is compelled to resolve towards the high extreme of the interval of perfect fourth. This should be taken as another evidence of the character of leading note that interval had. This same idea will be expressed again in 66.5-9, where he, once more, insists in the idea of the difficulty of singing more than three diesis one after the other.

Aristoxenus' own words (30.5-8)confirm that, whenhis contemporaries (οἱ πλεῖστοι τῶν νῦν) tried to play enharmonic music, they confused its intervals,

[1] Remember what we have already said about hearing intervals underneath 41 cents (Smith, Delgutte & Oxenham 2002; Rodman 2003).

[2] Winnington-Ingram (1965: 61) suggests, quite wisely under my opinion, that, bearing in mind all this information, the most distinctive quality in the enharmonic *genos* is not so much the division in quartertones as the indivisible *ditonon*. In this way, the character of double leading note would lose its importance in its internal tuning in favour of a more easily recognizable-and-performable-by-the-interpreter interval in this *genos*.

making them quite close to the chromatic. What should be understood of his assertion is that the practice of the enharmonic must have been in use, but, according to Aristoxenus' testimony, in the very corrupted or inexact way that led it to its extinction. On the basis of all this information, Hagel (2009) supports the idea that the chromatic wasreplacing the enharmonic *genos* without any doubt.

This same idea can be extracted from Ps. Plutarch (1137.D.10-F.3). This author also assures that the chromatic hadn't been used by the composers of tragedy, despite the fact that kitharody, much older that tragedy, had always used it and that it was considered older that the enharmonic *genos*. Ps. Plutarch claims that it was avoided by composers, not because they didn't know of its existence, but for personal election, because they felt closer to more solemn and conservative styles. He enumerates names as Pancrates, Tyrtaeus of Mantinea, Andreas of Corinth and Thrasylus of Phlia. However, avant-garde composers such as Euripides and Agathon started to use it as a way of filling in the gaps left empty by the enharmonic.[1]Besides, Ps. Plutarch (1145.A.4-D.8)adds that his contemporaries had given up the enharmonic*genos*, because, among other things, most of them didn't even have the capacity to understand the enharmonic intervals, thinking that its diesis are not detected by perception, so that they banishedthem from their singing. Thus, he is suggesting that those who claimed to be able to teach this *genos* and employ it would be cheating their colleagues.

In conclusion, it must be understood that these types of intervals could never be measured accurately by the singers' hearing. Therefore, they could not be isolated as sung intervals to perform melodies. If we mean to be correct, most probably Aristoxenus himself must not have known them, but his previous generations, for he makes a distinction between an old type of music (ἀρχαῖος) and another one that was already old-fashioned (ἀρχαϊκός) (Hagel 2009).Only Ps. Plutarch (1141.B.5-7) mentions diverse types of microtonal groups, attributing them to Polimnestus, of whom he says that "made dissolution and projection bigger". This may be meaning that this type of intervals had most probably not have been a structural part of melodies, but that they were used as embellishments or flourishments on real notes. The only circumstance in which they can be taken as part of a melodic sequence is if they can be understood as a double leading note. Maybe that is why Aristides Quintilianus (1.7.39-43) defines the diesis as the smallest vocal interval, as far as it is "dissolution of the voice" (διάλυσις τῆς φωνῆς οὖσα), opossite to tone, that is defined as the first intervallic magnitude that "tenses" the voice (i.e., "that is capable of be tuned", τόνος δὲ τὸ διὰ μέγεθος πρῶτον διατεῖνον τὴν φωνήν), next to the semitone, which is expressed as a "quasi-tone", due to our capacity to generate it (ἡμιτόνιον δὲ ἤτοι τὸ ἥμισυ τοῦ τόνου ἢ τὸ ἁπλῶς τόνῳ παραπλήσιον). However, these terms are not treated in

[1] See Hall (2007: 19) and Franklin (2005: 28).

Ps. Plutarch's text and, consequently, Mathiesen (1999: 537) suggests that Aristides Quintilianus must have obtained this information directly from the aristoxenic tradition. In any case, whatever the truth my be, we lack practical information that may confirm what the enharmonic *genos* was sung like and all we can do is apply rationality to the dark contents of ancient music treatises.

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